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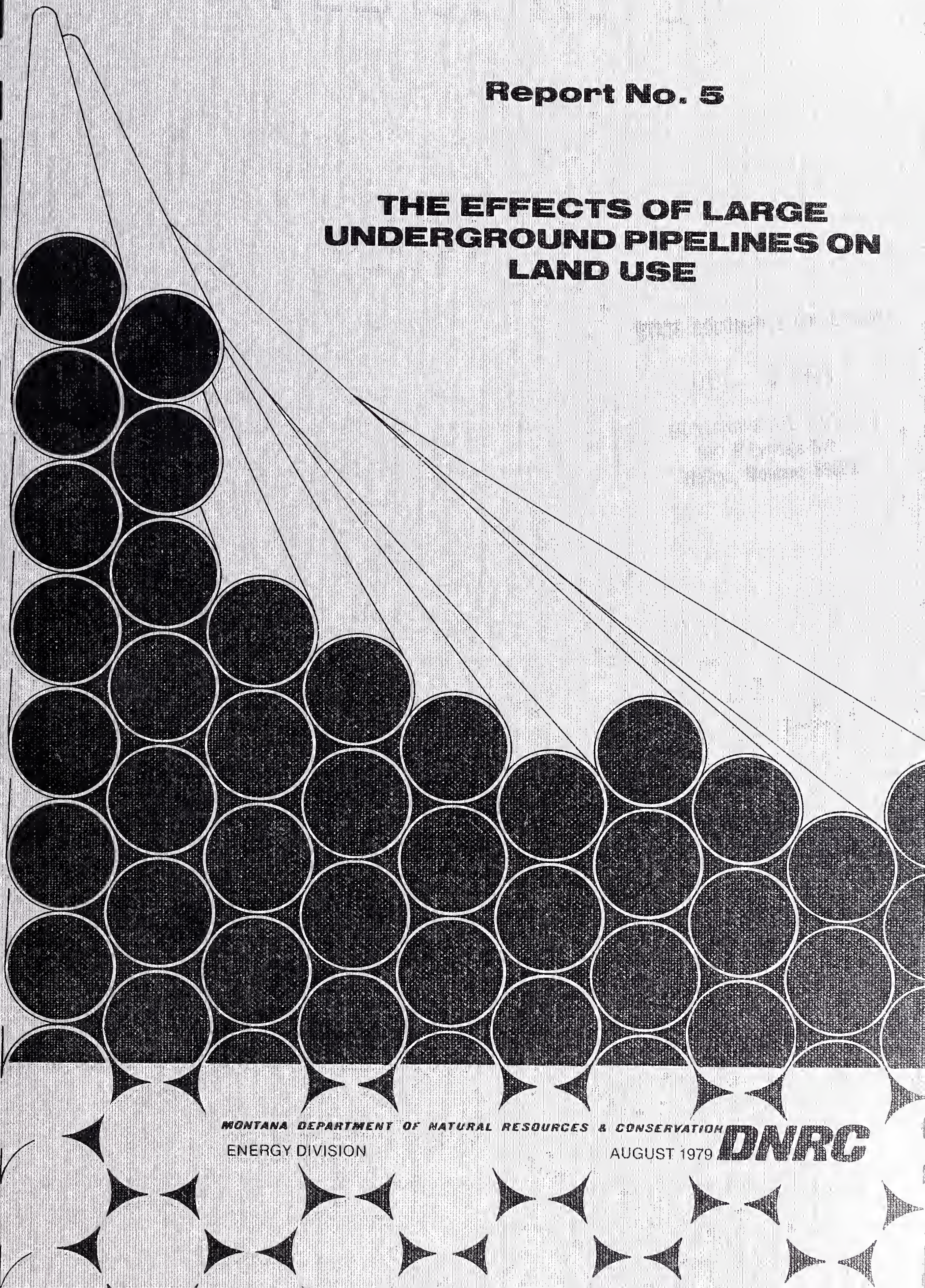
Report No. 5

THE EFFECTS OF LARGE UNDERGROUND PIPELINES ON LAND USE



MONTANA DEPARTMENT OF NATURAL RESOURCES & CONSERVATION DNRC
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Northern Tier Report No. 5

THE EFFECTS OF LARGE-DIAMETER UNDERGROUND CRUDE-OIL PIPELINES ON LAND USE

With Emphasis on the Proposed Northern Tier Pipeline in Montana

by
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August 1979

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ABBREVIATIONS

BLM	Bureau of Land Management
bu	bushel
cm	centimeter
DNRC	Department of Natural Resources and Conservation (Montana)
EIS	environmental impact statement
ft	foot
in	inch
km	kilometer
kV	kilovolt
m	meter
mi	mile
NTPC	Northern Tier Pipeline Company
NTPS	Northern Tier Pipeline System
RARE	Roadless Area Review and Evaluation
USDI	United States Department of the Interior
yr	year

ACKNOWLEDGEMENTS

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This report was prepared by Dave Janis, DNRC Energy Division, in consultation with Bret Brunner. Jan Konigsberg, Wilbur Rehmann, and Larry Thompson of the Energy Division assisted in the preparation of the report, which was edited by Kathy Hanson.

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CHAPTER ONE

INTRODUCTION

The following analysis of the effects of a large-diameter, underground, crude-oil pipeline on land use supplements the state's Draft EIS on the Proposed Northern Tier Pipeline System, prepared by the Montana Department of Natural Resources and Conservation (DNRC). The Northern Tier Pipeline Company (NTPC) has proposed a 102- to 107-cm-diameter (40- to 42-in-diameter underground pipeline to transport crude oil from a tanker port at Port Angeles, Washington, to Clearbrook, Minnesota, traversing approximately 1014 km (630 mi) of Montana en route.

The state's draft EIS discusses the impacts of Northern Tier's proposed route and alternative routes. The U.S. Bureau of Land Management (BLM) has also prepared a draft EIS (USDI 1979) on the proposed project.

This report:

1) Gives a general description of large-diameter, underground, crude-oil pipelines (such as the proposed Northern Tier Pipeline System, or NTPS)

2) Examines the effects of a pipeline on land use through discussion of considerations such as (a) federal, state, and local government jurisdiction over land uses, (b) the possible effects of a pipeline on existing and potential land uses, (c) easements, and (d) eminent domain

3) Identifies ways that adverse effects on land use from a pipeline system could be prevented or mitigated

While the report emphasizes effects on Montana land use, the information is generally applicable to study of the impacts a large, underground pipeline would have on land use in other parts of the country.

This report is one in a series of six reports prepared in conjunction with the state's draft EIS. The series consists of the following reports:

Report 1	The Effects of Large-Diameter Underground Crude-Oil Pipelines on Soils and Vegetation, with Emphasis on the Proposed Northern Tier Pipeline in Montana
Report 2	The Effects of Large-Diameter Underground Crude-Oil Pipelines on Wildlife, with Emphasis on the Proposed Northern Tier Pipeline in Montana

Report 3	The Effects of Large-Diameter Underground Crude-Oil Pipelines on Aquatic Life and Habitats, with Emphasis on the Proposed Northern Tier Pipeline in Montana
Report 4	Earthquake Hazard to the Proposed Northern Tier Pipeline in Montana
Report 5	The Effects of Large-Diameter Underground Crude-Oil Pipelines on Land Use, with Emphasis on the Proposed Northern Tier Pipeline in Montana
Report 6	Social and Economic Impacts of the Proposed Northern Tier Pipeline in Montana

The reports are available on request from the Montana Department of Natural Resources and Conservation, Energy Division, 32 South Ewing, Helena, Montana 59601, (406) 449-3780.

CHAPTER TWO

A GENERAL DESCRIPTION OF LARGE UNDERGROUND CRUDE-OIL PIPELINES

The following is a summary of the activities typically required to construct, operate and maintain, and abandon a large-diameter, underground, crude-oil pipeline system. The effects of these activities are then discussed in the chapter of this report titled "The Effects of a Pipeline on Land Use." More detailed discussions of pipeline system design and techniques of constructing, operating, and maintaining a pipeline are in chapters two ("Description and Justification of the Project as Proposed by NTPC") and five ("Engineering and Geotechnical Concerns") of the DNRC draft EIS.

SUMMARY OF ACTIVITIES

PIPELINE CONSTRUCTION

The construction of a large-diameter pipeline system would involve the following activities:

1) Making flights over the pipeline route prior to construction
2) Surveying and staking the centerline
3) Clearing vegetation from the construction right-of-way
4) Excavating the pipeline trench
5) Transporting pipe to the trench, welding pipe sections, placing them on skids, and wrapping pipe with a protective cover (pipe staging)
6) Laying the pipe and backfilling
7) Constructing crossings where a pipeline intersects rivers, streams, canals, roads, utility lines, and other pipelines
8) Testing the soundness of the pipe (hydrostatic testing)
9) Reclaiming construction sites

CONSTRUCTION OF FACILITIES ASSOCIATED WITH A PIPELINE

Facility construction would involve:

1) Establishing work camps for construction personnel where existing housing could not accommodate an influx of workers[1]

2) Possibly, constructing access roads to the pipeline and associated facilities[2]

3) Building pump stations and delivery facilities

4) Installing high-voltage electrical transmission lines serving pump stations and delivery facilities, and low-voltage distribution lines serving valves

5) Establishing storage yards for pipe and construction materials

6) Excavating material pits (such as gravel pits)

PIPELINE OPERATION AND MAINTENANCE

The following maintenance activities would take place during operation of a pipeline system:

1) Controlling growth of vegetation within the permanent right-of-way

2) Maintaining pump stations, delivery facilities, and powerlines

3) Possibly, maintaining access roads to the pipeline, pump stations, and delivery facilities

4) Making survey flights over the right-of-way

5) Controlling, containing, and cleaning up oil spills, and reclaiming spill areas

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[1] NTPC states that it will not establish work camps. However, camps might be established by NTPC contractors.

[2] For this report, access roads are defined as any road (including a spur road, right-of-way road, and construction traffic and passing lanes) that would be needed to reach a pipeline corridor or an existing road. Although NTPC has no plans to construct new access roads to its proposed route, new roads might be necessary with any of the alternative NTPS routes or the route of any other pipeline that might be proposed through Montana.

PIPELINE ABANDONMENT

The following activities would occur after completion of pipeline operation:

1) Flushing oil from the pipeline with water

2) Collecting and treating the water at wastewater treatment facilities, normally constructed at the discharge site

3) Possibly, removing pipe from the trench; this would involve many of the previously mentioned construction activities, including accommodating construction workers, clearing the right-of-way, excavating the pipeline trench, and reclaiming disturbed areas

CHAPTER THREE

CROSSING PUBLIC, TRIBAL, AND PRIVATE LAND

Prior to any construction, operation, maintenance, or abandonment activity, a pipeline company would obtain legal permission to cross tribal land, privately owned land, and land under the jurisdiction of federal, state, county, and local governments.

Permission to cross public land could be obtained through the purchase of easements from or the granting of special use permits by federal and state land management agencies (see tables 1 and 2). Permission to cross tribal or private land could be obtained through the purchase of land or easements. A pipeline company (such as NTPC) also could obtain private property without the consent of the landowner by exercising the power of eminent domain.

With purchase, ownership of a parcel of land would be transferred to the pipeline company. An easement would grant the company the right to use land without a transfer of ownership. A permit would grant the right to use land without the legal guarantees afforded by an easement or fee ownership. Because an easement is the most common type of permission given to cross land for purposes such as a pipeline, and because the taking of land through eminent domain is of special concern to private landowners, they are further discussed on the following pages.

EASEMENTS

A pipeline easement normally gives a pipeline company the right to: construct, maintain, and operate one pipeline under the surface of the owner's land; repair and replace the line if necessary; intersect with other pipelines; and manage the easement in a manner that prevents damage to the pipeline and interference with pipeline operation.

In many cases, the amount of land required for pipeline construction would be more than the amount required for operation and maintenance; this difference could be specified in the easement agreement. In addition, the amount of land actually used to construct, operate, and maintain a pipeline might be less than the amount of land the company was given permission to use. (In this report, the strip of land actually used for construction is referred to as the construction right-of-way; that used for operation and maintenance is referred to as the permanent right-of-way.)

The exact terms of an easement would vary, depending on the requirements of pipeline construction and the concerns of landowners. Before purchasing an easement the pipeline company would negotiate the terms of the easement with the landowner. For example, the width of the easement would be established, the duration of the easement determined, and the amount of

TABLE 1. Responsibilities of federal agencies regarding crude oil pipeline location and construction, and permits required for siting and construction that would affect land use.

Activity Requiring Action	Form of Action	Title of Act Providing Authority	Legal Reference[a]	Remarks
U.S. Department of Interior, Bureau of Land Management				
Construction on federal lands	Permits		43 CFR 2800 43 CFR 288	Lead agency in preparing environmental impact statements and issuing rights-of-way grants for federal lands
U.S. Department of Interior, Bureau of Reclamation				
Pipeline construction across the agency's irrigation districts	Permit or amended easement		43 CFR 230	
U.S. Department of Interior, Bureau of Sport Fisheries and Wildlife				
Construction in national wildlife refuges or wetland production areas	Crossing agreement		50 CFR 29.1 43 CFR 28.0	Examines applications for Corps of Engineers Sec. 10 and 404 permits and recommends approval or denial
U.S. Department of Agriculture, Forest Service				
Pipeline construction	Special use permit		36 CFR 251.50 et seq. 36 CFR 212.10	Establishes terms and conditions of construction on national forest land

TABLE 1. (Continued)

Activity requiring action	Form of action	Title of act providing authority	Legal reference[a]	Remarks
		U.S. Environmental Protection Agency		
Disposal of dredge material, waste water discharges, air pollution	Permit	Federal Water Pollution Control Act of 1972	33 CFR 209.120 40 CFR 124,125	Issues and oversees National Pollution Discharge elimination System Permits
		U.S. Army Corps of Engineers		
Construction of ports and related facilities and crossings of navigable waters	Permit		33 CFR 320-329	
		U.S. Department of Energy, Bonneville Power Administration		
Pipeline construction across, adjacent to, or within powerline rights-of-way	Joint use permit	BPA Act	16 USC 832	

SOURCE: USDI 1979

[a] CFR stands for Code of Federal Regulations. A reference such as 50 CFR 29.1 indicates title 50, section 29, subsection 1 of the regulations. USC stands for United States Codes, which are cited in the same manner.

TABLE 2. Responsibilities of state agencies regarding crude oil pipeline location and construction, and permits required for siting and construction that would affect land use.

Activity Requiring Action	Form of Action	Title of Act Providing Authority	Legal Reference[a]	Remarks
		Department of Highways		
Construction along and crossing highway rights-of-way	Encroachment permit		MCA 69-13-103; ARM 18-2.6 AI (2)-S6010 states provisions	Regulates the location of a crossing
Crossing highway right-of-way	Permit		MCA 7-14-2139, 2140	Permits construction of a ditch across a road; issued by whomever has jurisdiction over the road
		Department of State Lands		
Crossing state land	Easement		MCA 77-2-102, 103	
Crossing state land	Easement	Montana Antiquities Act	MCA 22-3-401 et. seq.	Granting of easement may depend on a survey of cultural resources
		Department of Natural Resources and Conservation		
Crossing state forest land	Easement		MCA 77-5-103	Forestry Division administers state forest lands; Board of Land Commissioners determines if easements are granted

TABLE 2. (Continued)

Activity Requiring Action	Form of Action	Title of Act Providing Authority	Legal Reference[a]	Remarks
Crossing designated floodplains	Permit	Floodway Management Act	MCA 76-5-101 et seq.	If local governing body has not adopted regulations, the department issues and enforces permits
Timber Removal	Permit		MCA 77-5-212	Permit for removal of commercial timber
Protection of lake areas	Permit		MCA 75-7-209	If the local governing body has not adopted regulations for lake areas, the department may, upon petition, adopt and enforce regulations until the governing body has adopted its own
		Department of Fish, Wildlife, and Parks		
Crossing of land owned or leased by the department	Easement		MCA 87-1-301	Easement granted by department commission
Stream crossing	Recommendation	Natural Streambed and Land Preservation Act	MCA 75-7-101	Can require on-site inspection. Acts in advisory capacity to local conservation districts

[a] MCA stands for Montana Codes Annotated. A reference such as MCA 75-7-101 indicates title 75, chapter 7, section 101 of the codes. ARM stands for Administrative Rules of Montana.

compensation paid the landowner for the interest in property agreed upon. Other special requirements mutually agreed upon by a landowner and pipeline company could be specified; for example, a landowner could agree not to plant trees or build structures on the permanent right-of-way for the life of a project; or the pipeline company could agree to follow particular reclamation and revegetation procedures.

Normally, pipeline easements remain in force for the useful life of a pipeline. With a project such as the proposed NTPS, the pipeline company could be expected to pay the landowner for: (1) the privilege of establishing a permanent easement across his/her land (compensation could be based on the number of acres included in the easement) and (2) damages to crops, rangeland, timber, fences, and any other property that would result from pipeline construction, operation, maintenance, and abandonment, or an accident (such as an oil spill).

EMINENT DOMAIN

Eminent domain is the right of the state to take or authorize the taking of private property without the owner's consent upon payment of just compensation. Property is taken (only after court approval) by purchasing the land or an easement to use the land.

Montana law grants eminent domain to common carrier pipelines (sec. 69-13-104, MCA). According to state law, a crude oil pipeline would be a common carrier pipeline if it would transport oil owned by companies other than the pipeline operator. Thus, NTPC would be a common carrier and would have the powers of eminent domain. Montana law confers upon common carrier pipelines the additional right "to lay, maintain, and operate a pipeline, together with telegraph and telephone lines incidental to and designed for use only in connection with the operation of such lines, and along, across, or under any public stream or highway" (sec. 69-13-103, MCA).

To justify the taking of private land in Montana, it must be found by a court that: (1) the use for which land would be taken is authorized by law, (2) the taking would be necessary to such use, (3) in the case of land already appropriated for a public use, the proposed use would be a more necessary public use, and (4) the taking would be made in a manner providing the greatest public benefit with the least private injury (sec. 70-30-110 and 111, MCA).

A pipeline company would initiate action to exercise eminent domain by filing a condemnation complaint in the district court for the county in which the property in question is situated. The complaint would identify the property being sought and the general route of the pipeline through the property. A summons to attend a condemnation hearing would then be issued to the landowner. At the hearing, the landowner or his legal counsel would be asked to show why the property should not be taken; any other party with an interest in the ownership of the land could also attend or be represented at the hearing.

The court would determine whether the taking of land for a pipeline is justified, and, if so, issue a preliminary condemnation order (1) establishing limits on the amount of property that could be taken and (2) identifying where the pipeline would cross the property, and the manner in which the crossing would be made.

The amount of compensation a landowner is paid is determined by three condemnation commissioners. The landowner and company each nominate one individual for the commission and the two commissioners nominate a third person; these three are then appointed by the court.

With purchase of land, the amount of compensation would be based on the actual value of the property to be taken and the reduced value of adjacent property at the time the hearings summons was served. With an easement, compensation would be based on: (1) the market value of the commodity that would be lost, such as crops and trees, and (2) the reduced value of the land subject to the easement.

When the commissioners notify the court of the amount of compensation to be paid, a landowner or company has thirty days to appeal the decision with the district court. If a landowner wins an appeal, he will be awarded the necessary expenses of the litigation (1977 Montana Constitution, Article II, sec. 29). When a company pays the court or the landowner the compensation, a final condemnation order is issued, the company receives the title or an easement to the land, and the landowner is given the compensation, either directly, or through the court.

CHAPTER FOUR

THE EFFECTS OF A PIPELINE ON LAND USE

For this report, the effects of a large-diameter, underground, crude-oil pipeline on land use in Montana are examined according to existing land use, potential land use, specially managed areas, planning and legal controls on land use, and land ownership. The primary effects of a pipeline system on land use would result from the establishment of a pipeline itself; the only effects of related facilities, such as pump stations and delivery facilities, would be the permanent removal of land from its original use and the preclusion of any future use other than for the facilities. Thus, this chapter focuses on the effects of a pipeline, not an entire pipeline system.

EFFECTS ON EXISTING LAND USE

LINEAR LAND USES

Linear patterns of land use include transportation and utility corridors, which could influence the location, design, construction, and operation of a pipeline.

Transportation Corridors

Small Roads and Highways. Where parallel pipeline construction and road or highway rights-of-way overlapped, pipeline construction could damage a road surface, pose a traffic hazard, and slow road traffic unless a detour were established. Restoration of a damaged road surface would increase the cost of pipeline construction.

Pipeline crossings at intersections with a small road or highway could be made by either excavating a trench across the road or drilling under the road. With trenching, the trench would usually be excavated up to both sides of the road, and pipe sections welded and laid; the crossing would then be made by excavating a trench across the road. A drilled crossing would be made by drilling horizontally under the road, installing pipe casing, and pulling the pipe through the casing.

At a trenched crossing, traffic might be blocked for the two or three days it could take to construct the crossing, unless a detour were established. Traffic would not be interrupted by a drilled crossing and such a crossing would avoid damage to the road surface.

Interstate Highways. While interstate highway rights-of-way are usually too narrow to accommodate an entire pipeline construction operation, interstate medians, shoulders, and traffic lanes could be used for pipeline construction, operation, and maintenance. This would maximize the use of existing corridors and provide access for pipeline construction, operation, and maintenance activities. The use of existing traffic lanes would also minimize disruption that would result from opening a new corridor.

However, the use of an interstate right-of-way would have many disadvantages. Even if an interstate right-of-way were wide enough to fully accommodate construction, interstate cut-and-fill slopes would be too steep (typically 6:1) to allow movement of construction machinery without grading, which would damage the road surface and disrupt traffic. In addition, the use of heavy equipment for highway construction and repair would increase the risk of a major oil spill along an interstate. The use of an interstate highway also would create safety hazards, including movement of construction vehicles in proximity to traffic lanes, creation of steep fill slopes, possible oil spills on the road surface, and distraction of motorists by pipeline-related activities.

Generally, a pipeline crossing at an interstate highway would be made by drilling horizontally under the interstate, and traffic would not be disrupted. The cost of crossing a four-lane interstate with a median would be considerably higher than crossing a two-lane highway or road.

Railroads. Where parallel pipeline and railroad rights-of-way overlapped, and pipeline construction extended onto the railroad bed, construction would be extremely costly, shutdown rail traffic, and damage the track and track bed. To proceed with construction within the bed of an operating railroad, existing track would have to be pulled up, the track bed graded to ground-level to accommodate movement of construction equipment, pipe laid, the trench backfilled, and the bed and track replaced. In some places, operating railroads located parallel to or crossing a pipeline could be used to transport pipe to staging areas, depending on the pipeline company's construction plan, the convenience of loading and unloading railroad cars, shipping costs, and other factors.

A pipeline could be situated within an abandoned railroad bed, but the amount of grading that would be required could make the use of an existing railroad corridor more expensive than the creation of a new pipeline corridor.

A pipeline crossing at a railroad would be constructed in basically the same manner as an interstate highway crossing (i.e., drilled), except it would be designed and constructed to accommodate more overhead weight (from rail traffic) than would an interstate crossing. Both the Department of Transportation and the railroad companies have regulations governing the design of railroad crossings. There also is an American National Standard Code for pressure piping. To prevent damage to railroad tracks and the track bed, earth padding, timbers, or other protection would be required where pipeline construction equipment crossed a railroad.

Utility Corridors

Overhead Utility Lines. Normally, many overhead electrical transmission and telephone lines are encountered during pipeline construction. The operation of equipment under these lines is hazardous and requires caution.

Most equipment would be able to cross under telephone lines; equipment too tall to pass under a line could be moved around the line, or the line could be moved or temporarily raised. The approximate height of powerlines is shown in table 3.

TABLE 3. Approximate minimum ground clearance for powerlines of different voltages.

Voltage (kV)	15	69	115	161	230	500
Clearance (ft)	22	24	25-27	27-29	30-31	35
Clearance (m)	6.7	7.3	7.6-8.2	8.2-8.8	9.1-9.5	10.7

The tallest pipeline construction equipment is usually used at unloading and staging areas, which are located away from powerlines as much as is possible; thus, high-voltage powerlines generally would not present a problem with regard to pipeline construction.

An electrical current could be induced in pipe that was buried or lying on the ground near a high-voltage line, creating the potential for electric shock and increasing pipe corrosion. These problems would generally be alleviated by installing grounding equipment and taking measures to prevent corrosion.

Underground Utility Lines. Where a pipeline would intersect underground electrical, telephone, gas, water, and sewer lines, or other oil lines, the utility company would be asked to mark the location of the line. Because a line can generally be located within two or three feet, breakage can usually be avoided if precautions (such as hand digging) are taken to confirm the location. If excavation would take place where it is not known a line exists (for example where power, telephone, or water lines are connected with residences) a break could temporarily disrupt service. Generally, pipeline construction would be planned to avoid (as much as possible) crossings with other lines and areas where other forms of construction were taking place.

Irrigation Canals. There are several ways of crossing irrigation canals, depending on their size and time of use. If pipeline construction would take place at a time of year when a canal was not being used, it could be temporarily closed with no adverse effects. During times of the year when it would be necessary to maintain water flows, a crossing could be made by drilling a pipeline tunnel under the irrigation canal or by installing a temporary irrigation pipe over the pipe trench. A canal crossing could be constructed in about two days; during the irrigation season, it could be scheduled to cause minimum disruption of water flows. However, improper or construction techniques or improper placement of pipe could cause structural damage to a canal, resulting in long-term disruption of irrigation.

SITE-ORIENTED LAND USES

Site-oriented land uses are those concentrated in a particular area, such as agriculture and urban, suburban, and industrial development. In the following discussion, the effects of pipeline construction and operation on site patterns of land use are examined.

Agriculture

The types of agricultural land uses considered in this report are: (1) crop production on irrigated farmland, (2) crop production on dry farmland, (3) grazing, and (4) timber production (on both publicly and privately owned land). Many of the impacts identified in this section relate to the more detailed discussion of impacts on soils and vegetation in Northern Tier Report No. 1.

Crop Production on Irrigated Farmland. Construction of a pipeline on irrigated land could result in a loss of crop production and an increase in the growth of noxious weeds. But if land disturbed by construction were successfully reclaimed and growth of noxious weeds controlled, the loss of productivity would generally be short-term. On land irrigated by canals, successful reclamation would depend on restoring canals to their original condition; on land irrigated by sprinklers it would require grading disturbed land to eliminate barriers to the movement of sprinklers. On land irrigated by either of these systems, the proper replacement of segregated topsoil would be extremely important. If construction and reclamation were completed between the harvesting and planting of crops, when land is not irrigated, it might be possible to eliminate any loss of productivity.

However, productivity within a construction right-of-way could be permanently reduced if topsoil removed during trenching were not segregated and properly replaced, if soil were compacted, and if soil horizons were mixed. A loss of productivity could extend to areas beyond the right-of-way if improper construction and reclamation techniques resulted in an interruption of water flows in canals or blocked sprinkler movement.

Long-term losses could also result from an oil spill or disturbance caused by maintenance--for example, if vehicles were driven on a permanent right-of-way or if a trench were reexcavated to repair the pipe. The effects of reexcavation would be similar to the effects of construction, including reduced productivity. If oil spilled into or near an irrigation canal during pipeline construction or operation, soils, crops, irrigation equipment, and stock ponds would be damaged. The removal of contaminated soil and water during spill cleanup could also reduce productivity.

Crop Production on Dry Farmland. The effects of pipeline construction on dry cropland would generally be limited to disruption of soils and loss of crop production within the right-of-way during the year of construction; however, if construction were confined to the period between harvest and sowing of crops, there would probably be no loss of crop production. If topsoil were segregated during trenching and properly replaced during reclamation, and if soil compaction were prevented or corrected, there would probably be no long-term loss of productivity.

The productivity of dry cropland in Montana is less than that of most irrigated lands; Montana wheat production in 1978 was approximately 30 bu/acre/yr on dry cropland and 50 bu/acre/yr on irrigated cropland (Montana Department of Agriculture 1978). Thus, the loss of productivity on dry cropland resulting from pipeline construction would generally be less than that on irrigated cropland.

Other possible effects of pipeline construction on dry cropland include the growth of noxious weeds within the right-of-way and lost productivity resulting from an oil spill. The extent of weed infestation would depend on the timing of construction and reclamation, the nature of nearby weed sources, and efforts to control weed growth. Northern Tier Report No. 1 provides a more detailed discussion of the effects of oil spills on soils and vegetation.

Livestock Grazing. Generally, pipeline construction would not affect the ability of rangeland to provide livestock forage. In most Montana rangelands that receive 30 to 41 cm (12 to 16 in) of precipitation a year, 10 to 16 ha (25 to 40 acres) are required to support one cow-calf unit (Teigen 1979). In most cases, the percentage of a rancher's land that would be disturbed by a 27-m-wide (90-ft-wide) construction right-of-way would not represent a great loss of productivity, although the cumulative loss of rangeland along the entire length of a pipeline would be more significant.

Rangelands are generally more difficult to reclaim than are croplands. While production in some areas may be fully restored shortly after construction by implementing proper reclamation and revegetation methods, it may take years or decades to reestablish native rangeland vegetation in some areas. (See Northern Tier Report No. 1 for a more detailed discussion of revegetation.) It might be necessary to fence livestock out of the right-of-way until grasses were reestablished; however, this would be practical only if the cost of fencing did not exceed the value of lost productivity.

Timber Production. The growth of timber within a permanent right-of-way would be prevented for the life of a pipeline project; this loss of production would be the most serious impact of a pipeline on commercial forests. Other adverse effects could include increased access into and human use of remote areas, alteration of wildlife habitat, reduced soil stability and increased erosion on steep slopes, growth of noxious weeds on the permanent right-of-way, and degradation of watersheds and visual resources.

Urban and Suburban Uses

A pipeline would have similar effects on urban and suburban areas, but effects would probably be more disruptive in urban areas. Construction of a pipeline within or near a community would affect residences, businesses, industries, schools, and traffic by creating dust, traffic congestion, and access problems. Buildings, traffic, and other human activity in suburban areas would slow construction, prolonging the effects. By itself, one of these impacts might not be disruptive, but in combination the impacts could be very disruptive.

Maintenance of a permanent right-of-way could have effects similar to (but less disruptive than) construction. Oil spills could interrupt traffic, create a fire hazard, and pollute water and septic systems. In addition, a permanent pipeline right-of-way could be a barrier to development; impede extension of public utilities, such as water and gas, possibly making them more expensive; and divide an area of common use, such as a residential area or a business district. However, creation of a right-of-way could prove advantageous by providing a "green belt" (or open space) or a bicycle, horse, ski, or snowmobile trail within a community.

Industrial Uses

Industrial uses include manufacturing, mining, and other forms of heavy industry. Industries that would be seriously affected by pipeline construction and operation could be expected to either request easement stipulations that would minimize damage or refuse to grant an easement. Construction could interfere with mining operations by restricting the use of heavy equipment and blasting. Depending on the location of a pipeline in relation to a mining area, interference could extend beyond the construction right-of-way; for example, if a pipeline crossed a coal seam, surface mining could be prevented for a distance on either side of the right-of-way.

EFFECTS ON POTENTIAL LAND USE

LINEAR LAND USES

Establishment of Transportation and Utility Corridors

The establishment of a pipeline might preclude the use of land within the permanent right-of-way for new roads or underground utility lines, such as telephone, gas, water, and sewer lines. With the possible exception of intersections of roads or utility lines with a pipeline corridor, a pipeline company would probably not share its right-of-way because construction and maintenance of new roads or utility lines would increase the risk of damaging a pipeline.

SITE-ORIENTED LAND USES

Agriculture

Crop Production on Irrigated Farmland. While crops could be grown on a permanent pipeline right-of-way, it could be difficult or impossible to develop new irrigation systems on land traversed by a pipeline. To install a sprinkler system, land might have to be graded to create a level surface that sprinklers could move over; grading could expose a pipeline or make it susceptible to damage by reducing the amount of earth over the line. The excavation of a canal above a pipeline might not be physically possible or might not be allowed by a pipeline company.

Crop Production on Dry Farmland. Crops could be produced on a permanent pipeline right-of-way. Thus, if a pipeline right-of-way were successfully reclaimed following construction, a pipeline would not affect the long-term potential of dry farmland to produce crops. The segregation of topsoil and subsoil during trenching and proper replacement of segregated soil during backfilling would be particularly important in maintaining potential productivity.

Livestock Grazing. Grazing would be permitted on a permanent pipeline right-of-way. The potential of land to accommodate grazing after construction of a pipeline would depend largely on the success of revegetation, particularly the species used to revegetate the construction right-of-way.

Timber Production. In most places, growth of trees within a permanent pipeline right-of-way would be prevented for the life of a pipeline project; this would represent a long-term loss of timber productivity. When operation of a pipeline ended, it could be difficult to reestablish timber stands in some areas (such as steep slopes), and reestablishment of stands would take many years. The increased access into and human use of commercial forest areas could increase the opportunity to use timber-producing areas for other purposes.

Urban and Suburban Development

The presence of the pipeline right-of-way would place constraints on urban and suburban development. No structures could be built on the right-of-way, and the pipeline would be a barrier to underground utility lines, such as gas, water, and sewer lines. However, a pipeline right-of-way could provide open space (Downey 1976).

Industrial Development

Some industrial land uses would be prohibited within the permanent pipeline right-of-way for the life of a pipeline project. For example, no mining could take place above a pipeline.

EFFECTS ON SPECIALLY MANAGED AREAS

Specially managed areas are parcels of land managed for the benefit of a particular resource or resource use, or a combination of uses--for example, water; wildlife; wilderness; recreation; unique geology, historic value, plant or animal life; and so forth. The kinds of specially managed areas in Montana that are administered by federal and state governments and other organizations are identified in tables 4, 5, and 6. The tables also identify: (1) the legal authority for management, (2) whether or not a pipeline could legally cross an area, (3) environmental stipulations that could be placed on a pipeline if a crossing were allowed, (4) the type of permission that would be granted for a crossing, and (5) other factors that would influence pipeline construction and operation.

TABLE 4. Federal special management areas that could affect the routing of a pipeline.

Area Classification	Crossing[a] Permitted	Form of Action Required	Environmental Stipulations	Legal Reference[b]	Remarks
U.S. Department of Interior, Bureau of Land Management					
Proposed wilderness and wilderness study areas	Yes			Federal Land Policy and Management Act of 1976	While a facility such as a pipeline generally is not permitted in a wilderness study area or an area proposed for wilderness designation, one could be authorized by congressional or executive order
Wild and scenic rivers	Yes	Right-of-way with special stipulation	Must not affect wild qualities of a wild and scenic river	Wild and Scenic Rivers Act	Crossings must be evaluated on a case-by-case basis
Critical wildlife habitat, endangered species habitat, recreation sites, archaeological sites	Yes	Right-of-way with special stipulation	Construction must not interfere with wildlife; native plants must be used to revegetate; archaeological sites must be salvaged or pre-excavated.	Federal Land Policy and Management	BLM area or district offices can designate land as critical wildlife habitat, endangered species habitat, recreational site, or archaeological site; agency policy defines the special conditions under which a pipeline may be constructed, as well as special enforcement procedures

TABLE 4. (Continued).

Area Classification	Crossing[a] Permitted	Form of Action Required	Environmental Stipulations	Legal References[b]	Remarks
	U.S. Department of Interior, Bureau of Sport Fisheries and Wildlife				
National wildlife refuges	Yes	Easement or permit	Must be compatible	50 CFR 29	
Waterfowl production areas	Yes	Easement or permit	Must be compatible; must not affect marsh.	50 CFR 29	
National fish hatcheries	Yes	Easement or permit	Must be compatible	50 CFR 29	
				43 CFR	
	U.S. Department of Interior, Bureau of Indian Affairs				
Tribal lands	Yes	Easement		25 CFR 161	Tribal council must grant permission; BIA must approve permission
	U.S. Department of Agriculture, Forest Service				
Wilderness areas	Yes			Wilderness Act of 1964	While a facility such as a pipeline generally is not permitted in wilderness, wilderness study or primitive areas, one could be authorized by congressional or executive order

TABLE 4. (Continued).

Area Classification	Crossing[a] Permitted	Form of Action Required	Environmental Stipulations	Legal Reference[b]	Remarks
Wilderness study areas	Yes	Permit			
Primitive areas	Yes			36 CFR 293.17	
Natural areas	No			36 CRF 251.23	No permanent improvements permitted
Wild and scenic rivers	Yes	Easement	Environmental impacts must be compatible with policy and with purpose of act	Wild and Scenic Rivers Act	The Secretary of Agriculture may grant easements
Recreation areas	Yes	Permit		36-CFR 294.1	Pipelines may be permitted by the Chief of the Forest Service or by officers of his designation

TABLE 4. (Continued).

Area Classification	Crossing[a] Permitted	Form of Action Required	Environmental Stipulations	Legal Reference[b]	Remarks
Scenic, geological, botanical, zoological, and paleontological areas	Yes	Permit	Scenic values must be protected; geological areas must be preserved as nearly as possible in an undisturbed condition; development sites should be located away from botanical, zoological, and paleontological areas	36-CFR 294.1	The approving officer has the authority to decide which areas are to be classified under this regulation and whether pipeline crossings will be permitted
Sites and areas (either designated or eligible) on the National Register of Historic Places	Yes	Permit	Must not affect cultural or historical values	36-CFR 800.4	If the forest supervisor finds that the effect of a proposed project would not be adverse, a positive recommendation is forwarded to director of the National Advisory Council on Historic Preservation

[a] "Yes" indicates that a crossing could be permitted; but it could also be denied. "No" indicates that a crossing is not permitted.

[b] CFR stands for Code of Federal Regulations. A reference such as 36 CFR 800.4 indicates title 36, section 800, subsection 4 of the codes.

TABLE 5. Montana special management areas that could affect the routing of a pipeline.

Area Classification	Crossing[a] permitted	Form of Action Required	Environmental Stipulations	Legal Reference[b]	Remarks
		Department of Health and Environmental Sciences			
Municipal Watersheds	Yes	Permit	Contamination of water sources prohibited	MCA 75-6-101 et. seq.	Montana's Safe Drinking Water Act prohibits the contamination of water sources but doesn't provide the department regulatory authority over siting or construction
		Department of State Lands			
Montana Natural Areas Program	No			MCA 76-12-101 et. seq.	No disturbance permitted
Conservation Easement	Yes	Easement		MCA 76-6-101 et. seq.	The Open Space Land Act allows designation by a public agency or private organization
		Department of Fish, Wildlife, and Parks			
State game management areas	Yes	Easement		MCA 87-1-301, 305	If management areas would be severely affected, a pipeline crossing might be prohibited

Table 5. (Continued).

Area Classification	Crossing[a] Permitted	Form of Action Required	Environmental Stipulations	Legal Reference[b]	Remarks
State parks, monuments recreation areas, fishing access sites, fish hatcheries	Yes	Easement		MCA 87-1-301	Pipeline crossing might be prohibited if an area would be adversely affected

[a] "Yes" indicates that a crossing could be permitted; but it could also be denied. "No" indicates that a crossing is not permitted.

[b] MCA stands for Montana Codes Annotated. A reference such as MCA 75-6-101 indicates title 75, chapter 6, section 101 of the codes.

TABLE 6. Miscellaneous special management areas that could affect the routing of a pipeline.

Area Classification	Crossing Permitted[a]	Remarks
Near-pristine sites	Yes	The Soil Conservation Service identifies near-pristine sites on federal, state, or private land. These include relict plant communities.
Snow-survey stations	Yes	The Soil Conservation Service administers snow survey stations but does not own the land; SCS reaches a cooperative agreement with the landowner

NOTE: These miscellaneous special management areas may be administered by the state or federal government or by private interests.

[a] "Yes" indicates that a crossing could be permitted; but it could also be denied. "No" indicates that a crossing is not permitted.

EFFECTS ON LAND USE PLANNING AND LEGAL CONTROLS ON LAND USE

ZONING

Zoning is the primary means of controlling the use of private land and other land under the jurisdiction of local governments. Under Montana law, there are four types of zoning: county zoning and municipal zoning, extraterritorial zoning (for areas outside incorporated municipal boundaries), and special zoning districts (Department of Community Affairs 1977).

In many cases, it is unclear if county, municipal, and extraterritorial zoning regulations would apply to a pipeline. Even if local zoning offices determined that regulations prohibit a pipeline, the power of eminent domain might supercede zoning regulations and land could be taken by condemnation.

Regulations for special zoning districts are even more unclear than county, municipal, and extraterritorial regulations. Although regulations in different districts are based on the same law, they vary greatly from district to district. It would be impossible to determine what effect special zoning regulations might have on a proposed pipeline without studying the regulations of each district a pipeline would pass through and determining the desires of district residents and county commissioners. In any case, eminent domain might supercede the regulations.

COMPREHENSIVE PLANNING

Comprehensive land use plans are not legally enforceable; however, a comprehensive plan normally represents the first step taken in developing land use regulations. When a local government has completed a comprehensive plan for land use, it can zone or institute other enforceable land use regulations. While a comprehensive plan cannot be legally enforced, it does indicate what concerns residents of an area have about land use and how they would prefer land to be used.

EFFECTS ON LAND OWNERSHIP

Construction and operation of a pipeline generally would have a much greater effect on small land holdings than on large holdings because the amount of land disturbed by construction and operation usually would represent a greater percentage of a small holding than a large holding. Restrictions on the use of a permanent right-of-way could also represent a more serious loss to owners of small holdings than owners of large holdings; the severity of a loss could be a determining factor in the amount of compensation granted for an easement. Impacts of a pipeline on small land holdings would probably be greatest near urban areas, where parcels are generally small.

CHAPTER FIVE

MITIGATING MEASURES

This chapter describes a range of measures that could be taken to reduce the severity of impacts on land use from construction, operation, and maintenance of a pipeline system. The measures pertain only to land use; consequently, some may conflict with measures pertaining to other concerns, such as soils and vegetation, wildlife, aquatic life and habitats, visual impacts, or pipeline engineering and economics.

To identify the measures that would provide the most effective mitigation of a project's overall impacts (not just its impacts on land use), it would be necessary to examine all the possible mitigating measures for all concerns and assess the trade-offs among concerns. Several other factors would influence selection of mitigating measures: the laws, regulations, and policies governing pipeline siting, construction, operation, and maintenance; the statutory authority to ensure implementation of measures; and the cost-effectiveness of mitigation in specific situations. Thus, the mitigating measures for land use that would be implemented for a particular project probably would not be identical to all those identified in this chapter.

Adverse effects of a pipeline on land use would be mitigated by taking these measures:

1) Locating a pipeline in areas where the potential for disturbance of land outside the right-of-way would be minimized (for example, through rural areas rather than urban, suburban, and industrial areas and through dry farmland rather than irrigated farmland).

2) Locating a pipeline where it would have the least adverse effect on a parcel of land.

3) Minimizing the amount of land required to construct and operate a pipeline by using (a) the narrowest possible construction and operation rights-of-way and (b) existing roads for access wherever possible.

4) Avoiding the location of a pipeline in areas that are of great value for resource uses other than a pipeline (for example, communities, productive agricultural land, and specially managed areas).

5) Where possible, locating a pipeline within an existing transportation or utility corridor.

6) Locating pump stations, delivery facilities, and other facilities associated with a pipeline where they would conflict the least with existing land use.

7) Preventing or repairing damage to existing roads or utility lines at intersections with a pipeline (for example, by resurfacing roads, controlling traffic, and replacing damaged utility poles).

8) Establishing detours to maintain traffic flow a pipeline intersects a road.

9) Minimizing crop losses on irrigated and dry cropland by: (a) locating a pipeline where it would cause the least possible damage to crops, (b) constructing a pipeline during times of the year when it would cause the least damage--for example, after harvest and before planting, and (c) handling soil in a manner that would maintain soil productivity--for example, segregating topsoil and subsoil during trenching and properly replacing soil during reclamation.

10) Implementing the mitigating measures for erosion control, revegetation, and weed control identified for soils and vegetation in Northern Tier Report No. 1.

11) In special management areas, carrying out construction in a manner that would minimize damage. This could be accomplished by constructing the line at the time of year and with the construction methods that would cause the least disturbance--for example, operating within the narrowest possible right-of-way.

12) Minimizing disruption of existing and planned land use by complying with local land use regulations and plans to the greatest extent possible.

GLOSSARY

centerline--The linear center of a pipeline right-of-way as surveyed and staked on the ground.

easement--A legal agreement in which a landowner grants the pipeline company the authority to carry on certain pipeline-related activities within a specified area.

construction easement--A legal agreement in which the landowners grant the pipeline company authority to carry out all activities necessary to install the pipeline. Usually granted for a wider parcel of land than the construction right-of-way.

permanent easement--A legal agreement in which the landowner grants the pipeline company authority to carry out pipeline operation and maintenance activities on the land in proximity to the pipeline. Usually granted for a wider parcel of land than the permanent right-of-way.

eminent domain--A government's right to take, or authorize the taking of privately owned land for public use. The owner is compensated.

right-of-way--The strip of land appropriated by a pipeline company through easement, condemnation, or fee ownership.

construction right-of-way--The strip of land, appropriated by a pipeline company, that is actually disturbed during construction of a pipeline; usually larger than the permanent right-of-way.

permanent right-of-way--The strip of land, appropriated by a pipeline company to accommodate maintenance activities during operation of the pipeline; usually narrower than the construction right-of-way.

route--The general location of a pipeline right-of-way, subject to adjustments of 1.6 km (1 mi) or more during centerline location.

special management area--Units of land administered in such a way that some land uses are prohibited or regulated.

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